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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Dengfeng Gao

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07/26/2006

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EXAMINER

COLAN, GIOVANNA B

ART UNIT

PAPER NUMBER

2162

DATE MAILED: 07/26/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/673,433	<b>Applicant(s)</b> GAO ET AL.	
	<b>Examiner</b> Giovanna Colan	<b>Art Unit</b> 2162	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 18 May 2006.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1- 6, 8, 10, 16 - 18, 20 - 24, 26 - 30, and 32 - 33 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-15 is/are allowed.
- 6) ☒ Claim(s) 1- 6, 8, 10, 16 - 18, 20 - 24, 26 - 30, and 32 - 33 is/are rejected.
- 7) ☒ Claim(s) 7, 9, 19, 25 and 31 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

**DETAILED ACTION**

1. This action is responsive to the Amendment filed on 05/18/2006.
2. No claims were amended. No claims were canceled. No claims were added.
3. This action is made Final.
4. Claims 1 – 6, 8, 10, 16 – 18, 20 – 24, 26 – 30, and 32 – 33 are pending in this application.
5. Claims 7, 9, 19, 25, and 31 are objected to being allowable.
6. Claims 11 – 15 are allowed.
7. Applicant's arguments filed on 05/18/2006 have been fully considered but they are not persuasive.

***Claim Rejections - 35 USC § 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was

not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

10. Claim 1 – 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al. (Chu hereinafter) (Non-Patent Literature: "Least Expected Cost Query Optimization, An exercise in Utility", ACM 1999, Philadelphia) view of Lohman et al. (Lohman hereinafter) (US Patent No. 5,301,317).

Regarding Claim 1, Chu discloses a method for estimating a query compilation time of a query optimizer comprising the steps of:

(a) receiving a query (Page 138, para. 2, lines 2 –3, Chu);

Chu further discloses join pairs for queries (Page 144, para. 86, lines 14 – 16, Chu), (c) for each join pair, identifying a set of differentiating properties and using said identified set of differentiating properties to calculate number of join plans (Page 144, para 86, lines 1 – 6, Chu<sup>1</sup>), and (d) estimating the compilation time from said calculated number of join plans for each type of join method (Page 140, para. 40, lines 2 – 8, Chu). However, Chu does not expressly disclose iteration. On the other hand, Lohman discloses (b) iterating through possible join pairs for said query (Fig. 8, Col. 13, lines 30 – 35, Lohman). It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate Lohman's teachings to Chu's system. Skilled

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<sup>1</sup> Wherein the relations being joined correspond to the set of differentiating properties.

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artisan would have been motivated to do so, as suggested by Lohman (Col. 5, lines 3 – 10, Lohman), to ensure that the space of feasible plans contains efficient plans without making it too big to be generated practically, and to provide automatically adjusting the search space in response to query execution time and guaranteeing inclusion of the universal optimum. Furthermore, both of the references (Chu and Lohman) are directed to the same field of endeavor of database management systems, such as, query optimization and compilation time estimation. This close relation between both of the references highly suggests an expectation of success.

Regarding Claim 2, the combination of Chu in view of Lohman discloses a method, wherein said join pairs are iterated by reusing existing join enumerator in said query optimizer (Col. 11, lines 36 – 43, Lohman).

Regarding Claim 3, the combination of Chu in view of Lohman discloses a method, wherein plan generation in said query optimizer is bypassed (Col. 2 and 6, lines 3 – 12 and 60 – 63; often not reasonable to generate all possible plans, respectively, Lohman)

Regarding Claim 4, the combination of Chu in view of Lohman discloses a method, wherein said set of differentiating properties comprises any of, or a combination of the following: order, data partition (Col. 7, lines 67 – 68, Lohman), pipelineability, data source, and presence of expensive predicates.

Regarding Claim 5, the combination of Chu in view of Lohman discloses a method, wherein said query is an SQL query (Col. 7, lines 4 – 5, Lohman).

Regarding Claim 6, the combination of Chu in view of Lohman discloses a method, wherein said estimation of compilation time is performed via a regression model (Page 139, para.23, lines 1 – 4, Chu<sup>2</sup>).

Regarding Claim 8, the combination of Chu in view of Lohman discloses a method, wherein said differentiating properties are generated in any of the following policies: a lazy policy in which said differentiating properties are generated naturally or an eager policy in which said differentiating properties are forcibly generated via an optimizer (Col. 5, lines 16 – 20, optimizer, Lohman).

Regarding Claim 10, the combination of Chu in view of Lohman discloses a method, wherein compilation time for multiple optimization levels are estimated in a single pass (Col. 9, lines 24 – 29, Lohman).

Regarding Claim 16, the combination of Chu in view of Lohman discloses a system for estimating query compilation time via reusing a join enumerator in a query optimizer, said system comprising:

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<sup>2</sup> Examiner interprets the bottom-up method as the regression model.

- (a) an interface to receive a query (Page 138, para. 2, lines 2 –3, Chu);
- (b) a join enumerator to iterate through possible join pairs for said query, said iteration performed via reusing said join enumerator in said query optimizer (Fig. 8, Col. 11 and 13, lines 36 – 43 and 30 – 35; respectively, Lohman);
- (c) a property identifier to identify, for each join pair, a set of differentiating properties and use said identified set of differentiating properties to calculate number of join plans (Page 144, para. 86, lines 1 – 6, Chu<sup>3</sup>); and
- (d) a compilation time estimator to estimate compilation time from said calculated number of join plans for each type of join method, wherein said number of join plans are calculated for any join type selected from a group consisting of: nested loops (Page 145, para. 105, lines 1 – 6, Chu), sort merge (Page 145, para. 107, lines 2 – 3, Chu), and hash.

Regarding Claim 17, the combination of Chu in view of Lohman discloses a system, wherein said set of differentiating properties comprises any of, or a combination of the following: order, data partition (Col. 7, lines 67 – 68, Lohman), pipelineability, data source, and presence of expensive predicates.

Regarding Claim 18, the combination of Chu in view of Lohman discloses a system, wherein said compilation time estimator uses a regression model to estimate said compilation time (Page 139, para.23, lines 1 – 4, Chu<sup>4</sup>).

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<sup>3</sup> Wherein the relations being joined correspond to the set of differentiating properties.

Regarding Claim 20, the combination of Chu in view of Lohman discloses a system, wherein said differentiating properties are generated in any of the following policies: a lazy policy in which said differentiating properties are generated naturally or an eager policy in which said differentiating properties are forcibly generated via a optimizer (Col. 5, lines 16 – 20, optimizer, Lohman).

Regarding Claim 21, the combination of Chu in view of Lohman discloses a system, wherein said query is an SQL query (Col. 7, lines 4 – 5, Lohman).

Regarding Claim 22, the combination of Chu in view of Lohman discloses a article of manufacture comprising computer usable medium having computer readable program code embodied therein estimating a query compilation time of a query optimizer via reusing an existing join enumerator in said query optimizer, said medium comprising:

- (a) computer readable program code aiding in receiving a query (Page 138, para. 2, lines 2 –3, Chu);
- (b) computer readable program code iterating through possible join pairs for said query (Fig. 8, Col. 13, lines 30 – 35, Lohman);

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<sup>4</sup> Examiner interprets the bottom-up method as the regression model.



(c) for each join sequence, computer readable program code identifying a set of differentiating properties and using said identified set of differentiating properties to calculate number of join plans (Page 144, para 86, lines 1 – 6, Chu<sup>5</sup>); and

(d) computer readable program code estimating compilation time from said calculated number of join plans for each type of join method (Page 140, para. 40, lines 2 – 8, Chu).

Regarding Claim 23, the combination of Chu in view of Lohman discloses a article of manufacture, wherein said estimation of compilation time is performed via a regression model (Page 139, para.23, lines 1 – 4, Chu<sup>6</sup>).

Regarding Claim 24, the combination of Chu in view of Lohman discloses a article of manufacture, wherein said set of differentiating properties comprises any of, or a combination of the following: order, data partition (Col. 7, lines 67 – 68, Lohman), pipelineability, data source, and presence of expensive predicates.

Regarding Claim 26, the combination of Chu in view of Lohman discloses a article of manufacture, wherein said differentiating properties are generated in any of the following policies: a lazy policy in which said differentiating properties are generated naturally or a eager policy in which said differentiating properties are forcibly generated via a optimizer (Col. 5, lines 16 – 20, optimizer, Lohman).

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<sup>5</sup> Wherein the relations being joined correspond to the set of differentiating properties.

Regarding Claim 27, the combination of Chu in view of Lohman discloses a article of manufacture, wherein said number of join plans are calculated for any join type selected from a group consisting of: nested loops join (NLJN) (Page 145, para. 105, lines 1 – 6, Chu), sort merge join (MGJN) (Page 145, para. 107, lines 2 – 3, Chu), and hash join (HSJN).

Regarding Claim 28, the combination of Chu in view of Lohman discloses a method for estimating query compilation time in a query optimizer, said method comprising the steps of:

bypassing plan generation and reusing a join enumerator of said query optimizer to identify number of joins (Col. 6, lines 60 – 63, Lohman<sup>7</sup>);

iterating through possible pairs for a query (Fig. 8, Col. 13, lines 30 – 35, Lohman);

for each join, accumulating a set of differentiating properties during enumeration and using said identified set of differentiating properties to calculate number of join plans (Page 144, para 86, lines 1 – 6, Chu<sup>8</sup>); and

estimating compilation time from said calculated number of join plans for each type of join method via a regression model (Page 140, para. 40, lines 2 – 8, Chu).

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<sup>6</sup> Examiner interprets the bottom-up method as the regression model.

<sup>7</sup> Wherein examiner interprets reducing the number of feasible plans as bypassing the plan generation claimed.

<sup>8</sup> Wherein the relations being joined correspond to the set of differentiating properties.

Regarding Claim 29, the combination of Chu in view of Lohman discloses a method, wherein said set of differentiating properties comprises any of, or a combination of the following: order, data partition (Col. 7, lines 67 – 68, Lohman), pipelineability, data source, and presence of expensive predicates.

Regarding Claim 30, the combination of Chu in view of Lohman discloses a method, wherein said query is an SQL query (Col. 7, lines 4 – 5, Lohman).

Regarding Claim 32, the combination of Chu in view of Lohman discloses a method, wherein said differentiating properties are generated in any of the following policies: a lazy policy in which said differentiating properties are generated naturally or an eager policy in which said differentiating properties are forcibly generated via a optimizer (Col. 5, lines 16 – 20, optimizer, Lohman).

Regarding Claim 33, the combination of Chu in view of Lohman discloses a method, wherein said number of join plans are calculated for any join type selected from a group consisting of: nested loops join (NLJN) (Page 145, para. 105, lines 1 – 6, Chu), sort merge join (MGJN) (Page 145, para. 107, lines 2 – 3, Chu), and hash join (HSJN).

***Allowable Subject Matter***

1. Claim 7, 9, 19, 25, and 31 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

2. Claims 11 – 15 are allowed over the prior art of record.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding independent claim 11, the prior art of record fails to disclose or suggest the claimed provision of: the method of estimating compilation time from said calculated number of join plans for each type of join method via a regression model as follows,

$$T = T_{inst} \times \sum (C_t \times P_t)$$

wherein  $T$  is a machine-dependent parameter representing time per instruction,  $C_t$  is a constant representing number of instructions to generate a join plan of type  $t$ , and  $P_t$  is an estimated number of join plans of type  $t$ ; in conjunction with remaining claim provisions is not taught or suggested, or obvious over the prior art of record or that encountered in searching the invention

The dependent claims 12 – 15 are being further limiting to the independent claims, definite and enabled by the Specification are also allowed.

### **Comments**

**The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. In no case may an applicant reply outside the SIX (6) MONTH statutory period or obtain an extension for more than FIVE (5) MONTHS beyond the date for reply set forth in an Office action. A fully responsive reply must be timely filed to avoid abandonment of this application.**

**Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."**

As allowable subject matter has been indicated, Applicant's response must either comply with all formal requirements or specifically traverse each requirement not complied with. See 37 CFR 1.111(b) and MPEP section 707.07(a).

### ***Response to Arguments***

1. Applicant argues that the prior art fails to disclose; “iterating through possible join pairs for a query or, for each join pair, identifying a set of differentiating properties and using the identifies set differentiating properties to calculate number of join plans, wherein the compilation time is estimated from the calculated number of join plans for each type of join method”.

Examiner respectfully disagrees. The combination of Chu in view of Lohman does disclose iterating through possible join pairs for a query or (Fig. 8, Col. 13, lines 30 – 35, Lohman). Wherein the loop shown in Figure 8 including the repetition of command steps, such as, **INCREMENT SEARCH SPACE SIZING PARAMETERS** and **SET  $i = i + 1$**  correspond to the step of iterating through the possible joins as claimed. In addition, the combination of Chu in view of Lohman further explicitly discloses the step of iterating (Col. 7, lines 11 – 14, Lohman). Furthermore, the combination of Chu in view of Lohman further disclose the limitation: for each join pair (Fig.8, item showing **SET  $i = 1$** , **SET  $i = i + 1$** , and **COMPUTE NUMBER N(i) OF PLANS IN SEARCH SPACE S(i)**, Lohman), identifying a set of differentiating properties and using the identifies set differentiating properties to calculate number of join plans (Fig. 8, item showing **REVISE**

**INTERNAL FEASIBLE JOIN FILTER CRITERIA ACCORDING TO SEARCH SPACE**

**SIZING PARAMENTERS**, Lohman), wherein the compilation time is estimated from the calculated number of join plans for each type of join method (Fig. 8, item showing **SELECT PLAN P AS OPTIMUM WITH COST C AND RETURN**, Lohman). Wherein the step of incrementing the count corresponds to the step of iterating through each join as claimed; wherein the internal feasible join filter criteria according to search space sizing parameters corresponds to the set of differentiating properties claimed; and wherein the cost C corresponds to the compilation time claimed.

2. Applicant argues that the prior art fails to disclose; “reusing a join enumerator to estimate compilation time of a query optimizer, said join enumerator iterating through possible join pairs for a query”.

Examiner respectfully disagrees. The combination of Chu in view of Lohman does disclose reusing a join enumerator to estimate compilation time of a query optimizer (Col 7, lines 48 – 59, Lohman). Wherein the step of having an adaptable join enumerator corresponds to the step of reusing the join enumerator claimed. Furthermore, the combination of Chu in view of Lohman further discloses said join enumerator iterating through possible join pairs for a query (See response to argument 1), and claim 2 citation in Office Action).

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3. Applicant argues that the prior art fails to disclose; "bypassing plan generation and reusing a join enumerator of the query optimizer to identify number of joins".

Examiner respectfully disagrees. The combination of Chu in view of Lohman does disclose bypassing plan generation (Col. 2 and 6, lines 3 – 12 and 60 – 63; often not reasonable to generate all possible plans, respectively, Lohman). Wherein the step of selecting and not always generating all possible plans corresponds to the step of bypassing plan generation as claimed. In addition, the combination of Chu in view of Lohman does disclose reusing a join enumerator of the query optimizer to identify number of joins (See response to argument 2), and claim 2 citation in Office Action).



***Conclusion***

1. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

2. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

***Prior Art Made Of Record***

1. Chu et al. (Non-Patent Literature: "Least Expected Cost Query Optimization, An exercise in Utility", ACM 1999, Philadelphia)
2. Lohman et al. (US Patent No. 5,301,317, issued: April 5, 1994) discloses a system for adapting query optimization effort to expected execution time.
3. Lohman et al. (US Patent No. 6,092,062) discloses a relational database query optimization to perform query evaluation plan, pruning based on the partition properties.
4. Hoang (US Patent No. 5,761,657) discloses a global optimization of correlated subqueries and exists predicates.


***Points Of Contact***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Giovanna Colan whose telephone number is (571) 272-2752. The examiner can normally be reached on 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Breene can be reached on (571) 272-4107. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Giovanna Colan  
Examiner  
Art Unit 2162  
July 18, 2006

  
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SA